

REMARKS

Claim Amendments:

Claims 21 and 43 have been amended to correct punctuation errors. New claims 44-47 further define the dehydrogenation process recited in claim 43. Support for these claims is found on page 15, lines 11 through 17 of the specification.

Rejections Under 35 U.S.C. §103:

General features/limitations of the processes claimed (claims 21-47)

Applicants maintain the combined teachings of the cited references do not show all the elements of the processes claimed. For example, the step of dehydrogenating the raffinate product containing metaxylene, orthoxylene and ethylbenzene to obtain an effluent containing styrene, metaxylene, orthoxylene, unconverted ethylbenzene and by-products is neither taught nor suggested by the combined teachings of the cited references.

The Examiner alleges that the only difference between the combined teachings of the cited references and the present invention is the sequence of steps. This is clearly not the case. The steps recited within the processes of this invention are distinct from those of the combined teachings of the cited references, as well as the sequence.

The processes claimed include a distinct hydrogenation step with distinct starting materials. With distinct starting materials, the dehydrogenation step of the claimed processes is performed with distinct reaction kinetics. The step of hydrogenating an essentially pure stream of ethylbenzene (99.5 to 99.7%) is substantially different from hydrogenating a mixture containing a “minor amount” of ethylbenzene. As shown in the application, Applicants prefer a distinct catalyst and reaction conditions (no steam) when hydrogenating this mixture than the catalyst and conditions disclosed by Lee. Based on the disclosures by Lee, one skilled in the art could not predict that over

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50% of the ethylbenzene present in minor amounts within mixtures can be converted to styrene. By processing only pure ethylbenzene, the combined teachings of the cited references provide no hint or suggestion as to the outcome of processing mixtures of xylenes with ethylbenzene. One skilled in the art has no guidance as to whether other compounds in the mixture provide competing reactions with ethylbenzene or react with the styrene produced to reduce the total yield.

The process of the present invention also provides a distinct reaction mixture of styrene, metaxylene, orthoxylene, unconverted ethylbenzene and by-products which requires separation of the styrene product. The combined teachings of the cited references do not disclose an equivalent step and therefore, provide no indication of how to separate styrene from such a reaction mixture. No evidence has been presented that the recovery of styrene from these mixtures at high purity levels of at least 99.8 % would be expected.

Combining the teachings of Magne-Dirsch and Lee, even with the benefit of hindsight, does not provide the dehydrogenation step or the separation step defined in all claims herein. The Examiner has provided no reason to ignore these critical limitations and has failed to provide sufficient evidence or reasoning to support a showing of *prima facie* obviousness. Therefore, withdrawal of the rejections and allowance of all pending claims is earnestly solicited.

Dependent claims

The dependent claims define methods with features that further distinguish the combined teachings of Magne-Dirsch and Lee, as discussed below.

New claims 44-47 define methods which recite preferred conditions for the dehydrogenation reaction recited in the processes of claim 43. These claims recite the use of reaction conditions (free of added steam) or catalysts (free of iron oxide or chlorine) distinct from those taught by Lee. These methods are further removed from the teachings of the combined references and are clearly unobvious.

Claim 43, dependent claim 22 and the claims which depend thereon define methods where the step of separating styrene from the mixture (18) is performed by a second adsorption column

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operating as a simulated moving bed to obtain 99.8 % pure styrene. No evidence has been presented that either Lee or Magne-Dirsch mentions the use of a simulated moving bed. Therefore, the combined teachings of these references do not suggest the use of such a column to isolate styrene.

Claim 27: This claim defines methods where the adsorbent used in the second adsorption column to isolate styrene is an X or Y zeolite. The examiner alleges the use of X or Y zeolite in the second adsorption column is functionally similar to the adsorption disclosed by Magne-Dirsch. This is not possible since applicants employ the second adsorption column to isolate styrene and not ethylbenzene. As mentioned above, the cited references do not even mention isolating styrene, let alone using an adsorption column to do so.

Claim 38 This claim defines methods where a second stream is hydrogenated. The examiner has indicated this claim is allowable.

Claim 42 This claim defines processes where the amount of ethylbenzene within the mixture to be dehydrogenated is about 7% by weight. The cited references provide no hint of dehydrogenating a mixture with such a low concentration of starting material to obtain styrene.

The examiner has yet to address the subject matter of claim 42. The remarks made in the office action of July 2007 pertain to claims 39 and 40 where the amount of ethylbenzene in the isomerization feed is defined.

In view of the unique features discussed above, applicants maintain claims 21-47 are unobvious,

Obviousness-type Double Patenting:

The methods claimed herein are clearly patentably distinct from the methods defined in claims 1-20 of U.S. Patent 6,841,714 such that there is no basis for the rejection under the doctrine of obviousness type double patenting. The methods for producing ethyl benzene defined by the claims of U.S. Patent 6,841,714 provide no hint or suggestion of the methods for producing ethylbenzene and styrene claimed herein. The claims of U.S. Patent 6,841,714 do not include the

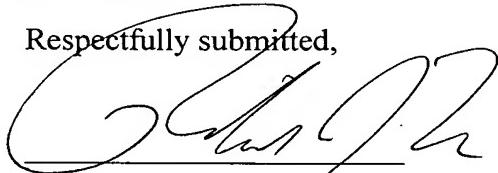
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dehydrogenation step or the isolation of styrene required of the methods claimed herein and no evidence has been presented to show or suggest it would be obvious for one skilled in the art to do so. The dehydrogenation methods of Lee are patentably distinct from dehydrogenation methods of the processes claimed herein.

Based on the above remarks, Applicants submit that all pending claims are in a form suitable for allowance and patentable over the cited references. Therefore, withdrawal of the rejections and allowance of these claims are earnestly solicited.

The Commissioner is hereby authorized to charge any fees associated with this response or credit any overpayment to Deposit Account No. 13-3402.

Respectfully submitted,



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